

***PSEUDODIPHASCON ARROWSMITHI*, A NEW SPECIES OF TARDIGRADE
FROM BRITISH COLUMBIA, CANADA (MACROBIOTIDAE:
EUTARDIGRADA: TARDIGRADA)**

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ABSTRACT

A new species of macrobiotid tardigrade was found on two mountains on Vancouver Island, British Columbia, during a study of the tardigrades on five mountains on the island. *Pseudodiphascon arrowsmithi*, n. sp., is distinguished from other species in the genus by its three large macropiloids with the third as long as or longer than the first, the very large micropiloid and the presence of lunules.

INTRODUCTION

Because the literature dealing with tardigrades in Canada, and particularly in British Columbia, is very sparse, a survey of tardigrades on Vancouver Island was undertaken to document their presence and to compare it with the only two previous publications on tardigrades from B. C. (Richters, 1908; Murray, 1910). Three other publications (Mathews, 1938; Baumann, 1960; Schuster and Grigarick, 1965) listing tardigrades from B. C. merely reiterate the species found by Richters and Murray.

MATERIALS AND METHODS

A total of 41 specimens of *Pseudodiphascon arrowsmithi*, n. sp., were collected on two mountains on Vancouver Island (Fig. 1): 14 were collected at 760 m elevation on Green Mountain in the moss *Dicranum fuscescens* on 17 July 1986, and 27 on Mt. Arrowsmith--26 on 09 July 1986 at 760 m in three species of mosses, *D. fuscescens*, *Claopodium bolanderi* and *Mnium spinulosum*, and one individual on 10 July 1987 at 1370 m in *D. fuscescens*.

The samples of moss were placed in paper bags and air-dried for several months. Each sample was then removed from the bag, placed in a stoppered funnel and allowed to soak in water for eight hours, after which the moss was removed and shaken in a separate container of water several times. The water and its contents were poured into a 45 µm mesh sieve to retain the tardigrades, which were placed in a gridded petri dish and extracted using a stereomicroscope. Each tardigrade was placed in Hoyer's mounting medium on a microscope slide and sealed with a cover slip. After complete drying of the mountant the cover slip was ringed with nail polish to prevent further air penetration.

Identifications were made using a phase-contrast compound microscope with oil immersion. All measurements were made using a calibrated eyepiece micrometer. Buccal tube length was considered the distance between the anterior end of the buccal tube excluding the mouth ring and the beginning of the spiralling; pharyngeal tube length was the distance from the beginning of the spiralling to the pharyngeal apophyses; and total length of the tardigrade was the distance from the anterior end of the head to the junction of the fourth pair of legs. The drawings were made with a drawing tube attached to the compound microscope.

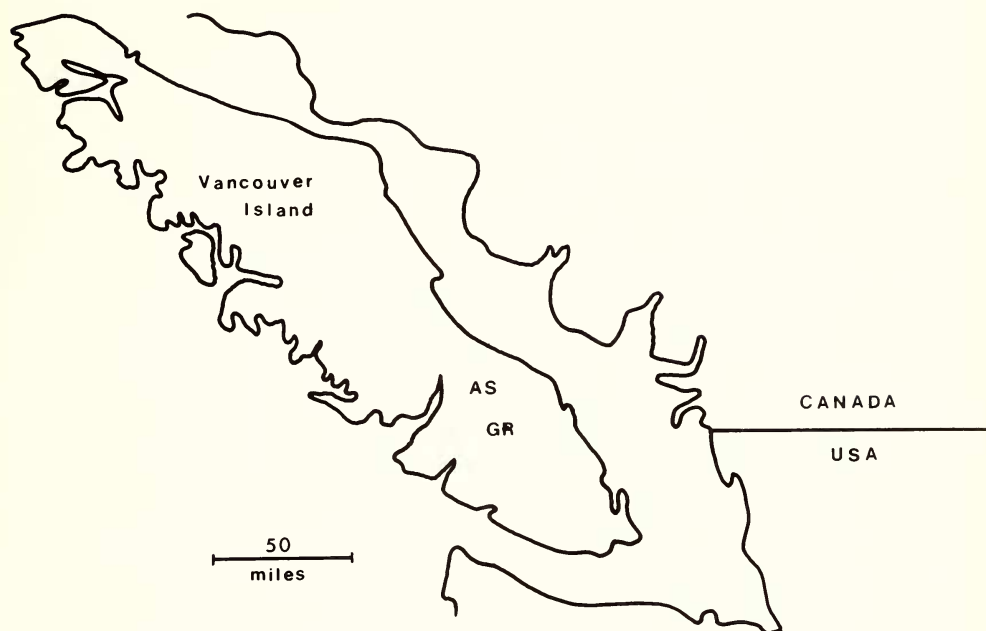


Figure 1. Location of sampling areas on Vancouver Island, British Columbia, Canada. AS = Mt. Arrowsmith, GR = Green Mountain.

TAXONOMIC ACCOUNT

Eutardigrada Marcus, 1927

Macrobiotidae Thulin, 1928

Pseudodiphascon Ramazzotti, 1964

Pseudodiphascon arrowsmithi, n. sp.

(Fig. 2)

Description. Holotype. Total length 430 μm ; colorless; cuticle smooth; eyes absent (Fig. 2A). Ten buccal lamellae present. Mouth ring with crests and distinct dentation, rectangular-shaped. Buccal tube with ventral tube support, extended almost to stylet support insertions; buccal tube length 26 μm , width 4.4 μm . Pharyngeal tube walls thickened, spiralled and flexible; length 19 μm , width 4.4 μm ; pharyngeal tube with evident spiralling starts immediately below stylet support insertions. Pharyngeal bulb large and round. Pharyngeal apophyses large; 3 macroplacoids, the first 5.5 μm long, second 3.1 μm and third 5.5, third with inward-projecting enlargement at posterior end; microplacoid large, 3.1 μm (Fig. 2B). All legs small, with fourth pair slightly smaller than the first 3 pairs. Claw sequence 2112; claws on 4th pair of legs larger than on first 3 pairs; primary branch of internal and external claws with 2 accessory points; lunules present but small, more evident on claws of 4th leg (Figs. 2C, 2D). Collected at 760 m on Green Mountain in the moss *D. fuscescens*, 17 July 1986. USNM #235439.

Paratypes. Total lengths 206-515 μm . Buccal tube lengths 16-27 μm , widths 2.0-4.4 μm ; pharyngeal tube lengths 11-19 μm , widths 2.0-4.4 μm . First macroplacoid lengths 1.9-5.5 μm ; second 1.3-4.4 μm ; third 2.5-6.3 μm ; the third is usually as long as or longer than the first; microplacoid 1.3-3.8 μm . USNM #235437, 235438, 2 specimens; Dastych collection, 1 specimen; Kristensen collection, 1 specimen; Nelson collection, 2 specimens; Kathman collection, 34 specimens; all from Mt. Arrowsmith or Green Mountain on Vancouver Island.

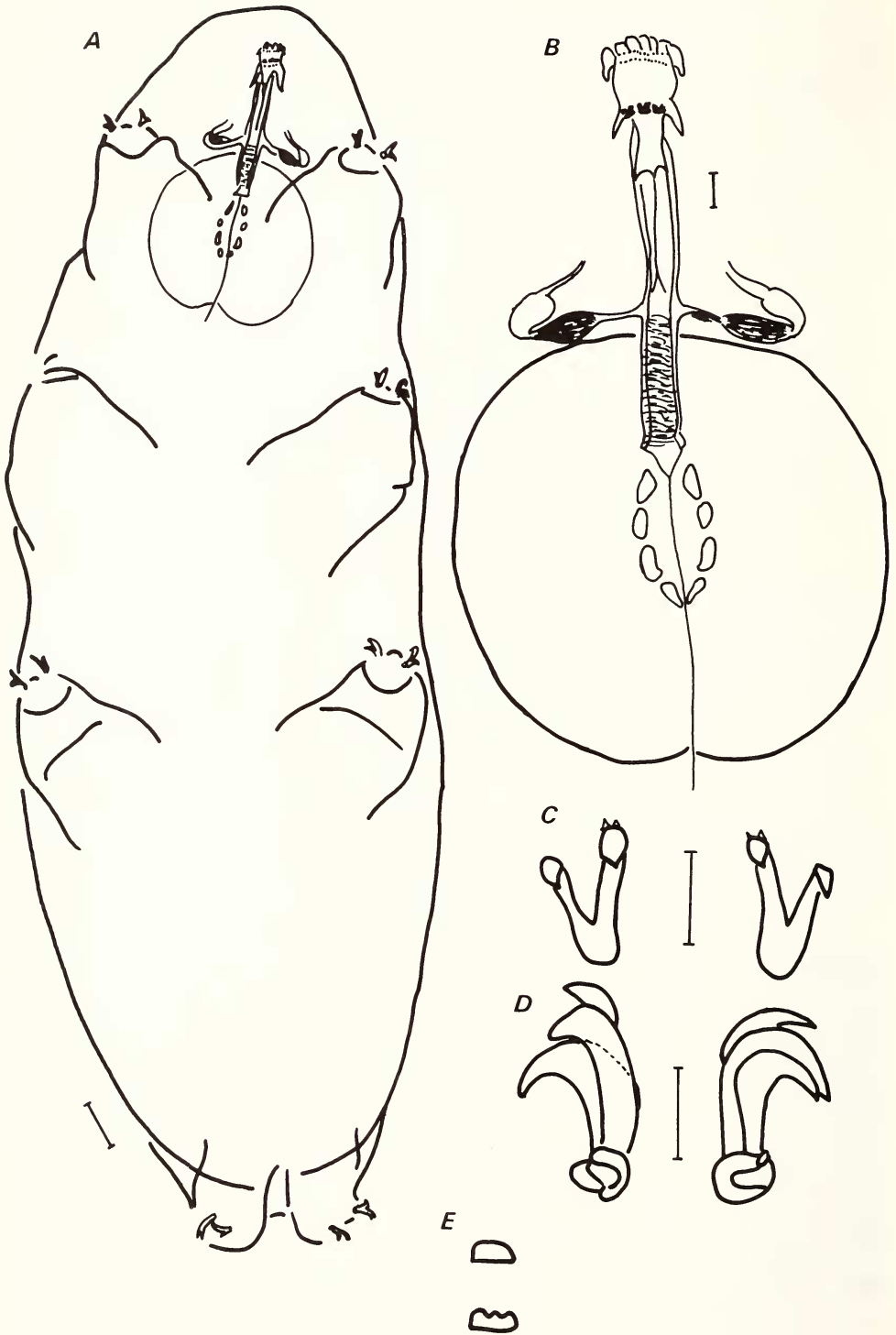


Figure 2. *Pseudodiphascon arrowsmithi*. A, Whole animal, ventral view; B, Buccopharyngeal apparatus; C, Claws, 2nd pair of legs; D, Claws, 4th pair of legs; E, Profile of macroplacoids, a = *arrowsmithi*, b = *bindae*. Scale bars in μm as follows: A, 20; B, 6.3; C-D, 4.8; E, no scale.

Type locality. Northwest slope of Mt. Arrowsmith at 760 and 1370 m and southwest aspect of Green Mountain at 760 m, both on Vancouver Island, British Columbia, Canada.

Etymology. Named after Mt. Arrowsmith, one of the mountains on which it was collected. Although the International Commission of Zoological Nomenclature recommends the "ensis" or "iensis" ending for geographical locations, the alternative procedure (Appendix D, Section IV, 22b) of using the masculine noun in the genitive case is adopted here as it is more euphonious.

DISCUSSION

Three of the four known species of *Pseudodiphascon* have been tentatively placed in this genus despite incomplete descriptions or lack of specimens to allow sufficient detail of important morphological characters. The original descriptions do not mention a spiralled flexible pharyngeal tube nor a ventral tube support in the buccal tube for *P. diphasconoide* Iharos, 1969, *P. inflexum* Arcidiacono, 1964, and *P. dubius* Schuster and Toftner, 1982. *P. diphasconoide* appears to be a much smaller tardigrade, with a thinner and shorter buccopharyngeal tube than *P. arrowsmithi*. *P. diphasconoide* has 2 small round macroplacoids, with the first a little longer than the second, and no microplacoid. This species was found only in Vietnam. The total length of *P. inflexum* coincides with that of *P. arrowsmithi*, but the buccopharyngeal tube is much narrower in *P. inflexum*. *P. inflexum* has 2 macroplacoids, the first longer than the second, and a very small microplacoid. The dentate lunule in *P. inflexum* is very large with 8-12 teeth, whereas in *P. arrowsmithi* it is very small with no discernable dentation. *P. inflexum* has been collected only in Sicily. *P. dubius* is a small tardigrade (length 240 μm) with a thin, short buccopharyngeal tube (length 31 μm). There are 3 small macroplacoids, all equal in length (1.5 μm) and a minute microplacoid. This species has only been reported from the Dominican Republic. *P. bindae* Christenberry and Higgins, 1979, collected in Alabama, USA, is the species most closely related to *P. arrowsmithi*. The largest specimen found was 437 μm (cf. 515 μm for *P. arrowsmithi*). Christenberry and Higgins (1979) stated that the 10 buccal lamellae could only be seen using SEM; in *P. arrowsmithi* they are evident with a phase microscope. Eyes are absent in *P. arrowsmithi* and present in *P. bindae*. There is no evident dentation above the crests in *P. bindae*. The buccal and pharyngeal tubes are longer in *P. bindae* (27-44 μm ; 16-35 μm , respectively) than in *P. arrowsmithi* (16-27 μm ; 11-19 μm , respectively); combined length for *P. bindae* is 43-79 μm , whereas for *P. arrowsmithi* it is 29-45 μm . The width of the buccopharyngeal tube for *P. bindae* and *P. arrowsmithi* is about the same (2.4-4.0 μm , 2.0-4.4 μm , respectively), but the ratio of width to length for *P. bindae* is much larger. The spiralling in *P. arrowsmithi* starts immediately below the insertion of the stylet supports and is a tight, dense type of spiralling, often difficult to see, whereas in *P. bindae* it begins well below the stylet support insertions and is a large, loose type of spiralling, easily seen. In *P. bindae* the first macroplacoid is always the longest and the second is the shortest, with the microplacoid slightly shorter than the second macroplacoid. In profile the macroplacoids of *P. arrowsmithi* are always smooth-edged, whereas in *P. bindae* they are rough (Fig. 1E). In *P. arrowsmithi* the third macroplacoid is equal to or longer than the first, and in some cases the second is only slightly shorter than the first. The microplacoid is very large, often equal to or larger than the second macroplacoid. Lunules are absent on *P. bindae* and present on *P. arrowsmithi*.

It appears that *P. arrowsmithi* could be classified as one of Ramazzotti and Maucci's (1983) montane or alpine species, since it was collected only at 760 m or higher on Vancouver Island, despite many samples of the same moss species being collected at several lower elevations, down to sea level. The two mountains on which it was found are approximately 26 km apart.

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LITERATURE CITED

- Baumann, H. 1960. Beitrag zur Kenntnis der Tardigraden in Nord-Amerika. *Zool. Anz.* 165:123-128.
 Christenberry, D. and R. P. Higgins. 1979. A new species of *Pseudodiphascon* (Tardigrada) from Alabama. *Trans. Amer. Microsc. Soc.* 98:508-514.
 Mathews, G. B. 1938. Tardigrada from North America. *Amer. Midl. Nat.* 19:619-627.
 Murray, J. 1910. Canadian Tardigrada. Pp. 159-178 in Report for the Scientific Investigation of the British Antarctic Expedition 1907-1909, vol. 1, London.
 Ramazzotti, G. and W. Maucci. 1983. Il phylum Tardigrada. *Mem. Ist. Ital. Idrobiol.* 41:1-1012.
 Richters, F. 1908. Beitrag zur Kenntnis der Moosfauna Australiens und der Inseln des Pazifischen Ozeans. *Zool. Jahrb. Abt. Syst. Oekol. Geogr. Tiere* 26:196-213.
 Schuster, R. O. and A. A. Grigarick. 1965. Tardigrada from western North America with emphasis on the fauna of California. *Univ. Calif. Publ. Zool.* 76:1-67.

NEW AND LITTLE KNOWN SCALE INSECTS (HOMOPTERA: COCCOIDEA) FROM BRITISH COLUMBIA

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ABSTRACT

Thirty-six species of scale insects (Coccoidea) belonging to 6 families were recovered during a recent collecting trip in British Columbia. Of these, 16 species (*Orthezia newcomeri*, *Anisococcus oregonensis*, *Heterococcus nudus*, *Phenacoccus capensis*, *Phenacoccus colemani*, *Phenacoccus solani*, *Spilococcus geraniae*, *Spilococcus keiferi*, *Tridiscus* sp., *Trionymus caricis*, *Trionymus utahensis*, *Acanthococcus greeni*, *Physokermes concolor*, *Physokermes hemicryphus*, *Physokermes taxifoliae*, *Stramenaspis kelloggi*) are new records for Canada and 26 new for British Columbia. The latter now has 42 species. The level of infestation, phenological stage, host plant data (including several new associations) and the localities of collections are also presented.

Résumé

Lors d'un récent voyage de cueillette effectué en Colombie-Britannique, on a rapporté trente-six espèces de cochenilles (Coccoidea) appartenant à 6 familles. Seize de ces espèces (*Orthezia newcomeri*, *Anisococcus oregonensis*, *Heterococcus nudus*, *Phenacoccus capensis*, *Phenacoccus colemani*, *Phenacoccus solani*, *Spilococcus geraniae*, *Spilococcus keiferi*, *Tridiscus* sp., *Trionymus caricis*, *Trionymus utahensis*, *Acanthococcus greeni*, *Physokermes concolor*, *Physokermes hemicryphus*, *Physokermes taxifoliae*, *Stramenaspis kelloggi*) sont de nouveaux records pour le Canada, et 26 d'entre elles sont nouvelles en Colombie-Britannique, qui compte maintenant 42 espèces. Le rapport traite du degré d'infestation et du stade phénologique; il fournit également des données sur les plantes hôtes (y compris plusieurs nouvelles associations) et sur les localités où a eu lieu la cueillette.

INTRODUCTION

The scale insect fauna of Canada is poorly known. Scudder (1979) noted that 56 species have been recorded from Canada. No comprehensive work exists for the Coccoidea of Canada, however, Footitt and Williams (pers. comm.) have prepared a list of the scale insect species in the slide holdings of the Canadian National Collection.